Release 2023 R1 Highlights

Ansys Rocky

Beyond traditional DEM: Discrete Solid Mechanics Simulation

DEM in 2000s

- Few **100s thousand** particles
- Spheres or glued-spheres only
- Mainly R&D tool

	Particle Shapes	Breakage	Native GPU	Multiphysics Integration	Multi-GPU	Flexible Particles	Coarse Grain	Innovative API	Enhanced HPC!	Particle Assembly SPH-DEM	Particles and Fluids solvers with a unique UI
... The 2000s	2011	2012	2015	2016	2017	2018	2019	2020	2021	2022	2023

Strong R&D investment!

NVidia DGX A100

Rocky 2023R1 Today

- **100s million particles!**
- Shapes / fibers/Breakage
- Multi CPU, Multi GPU
- Multiphysics Engineering tool
- Cloud able
- Full integration with Ansys
- Native SPH

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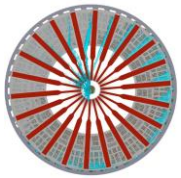
2023R1 Highlights

Ansys 2023R1 Take A Leap Of Certainty

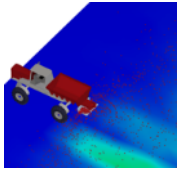


Smoothed-Particle Hydrodynamic (SPH)

Integrated SPH-DEM with unique easy to use GUI for applications with particles and fluids

Ansys Integration

Expanding CFD-DEM through 2-way coupling via Ansys Workbench



Injection Points

New capability to model applications with moving inlet and outlet for particles and fluids

…And More

Performance improvement, Joint statistics for multi elements particles

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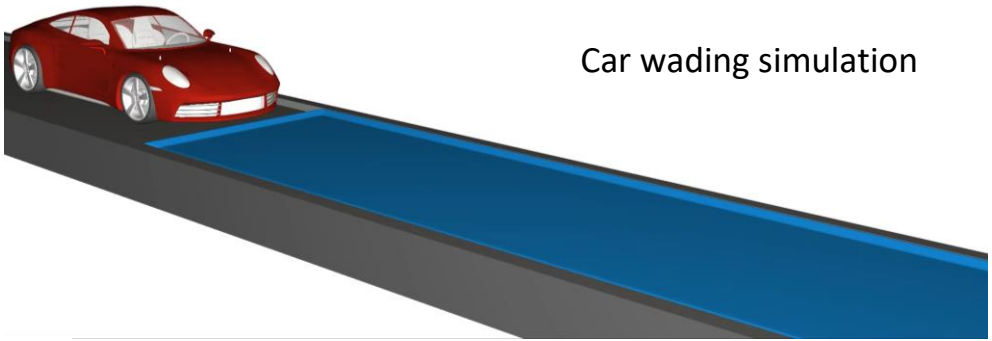
Smoothed-Particle Hydrodynamic (SPH)

Ansys

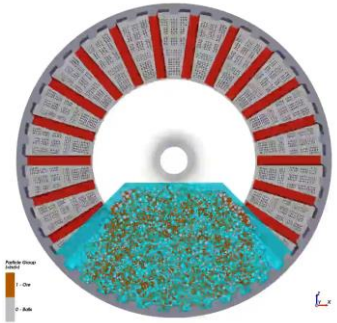
Smoothed Particles Hydrodynamic

SPH: a fast meshless CFD, in the same DEM simulation workflow

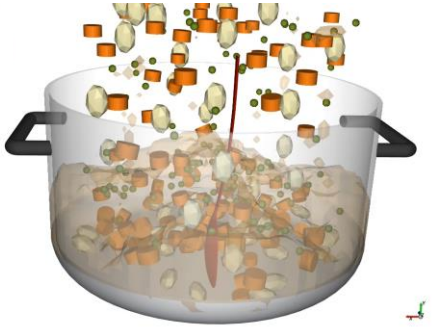
- Enhanced solutions for solid-fluid applications with free surface flows
- Develop an efficient methodology to solve problems that include large solids
- Offer a fully coupled SPH-DEM solution to solve engineering problems
- Multi-GPU support, for DEM and SPH



Car wading simulation



Slurry mill: grinding equipment, using liquid, ores and steel balls.*



Food industry: thermal simulation with particles and fluids.

** Video kindly provided by WEIR Minerals*

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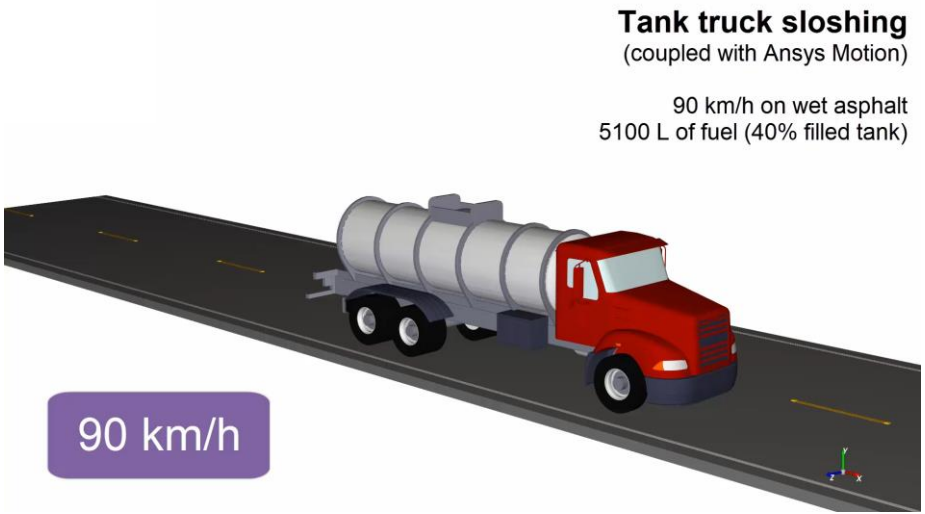
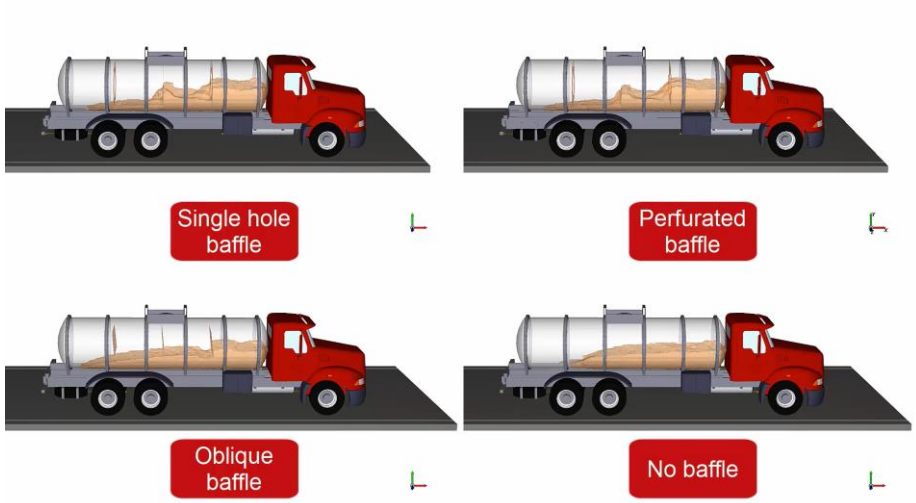
SPH application : Tank Sloshing



Tank Truck Sloshing



Impact of Different Baffles

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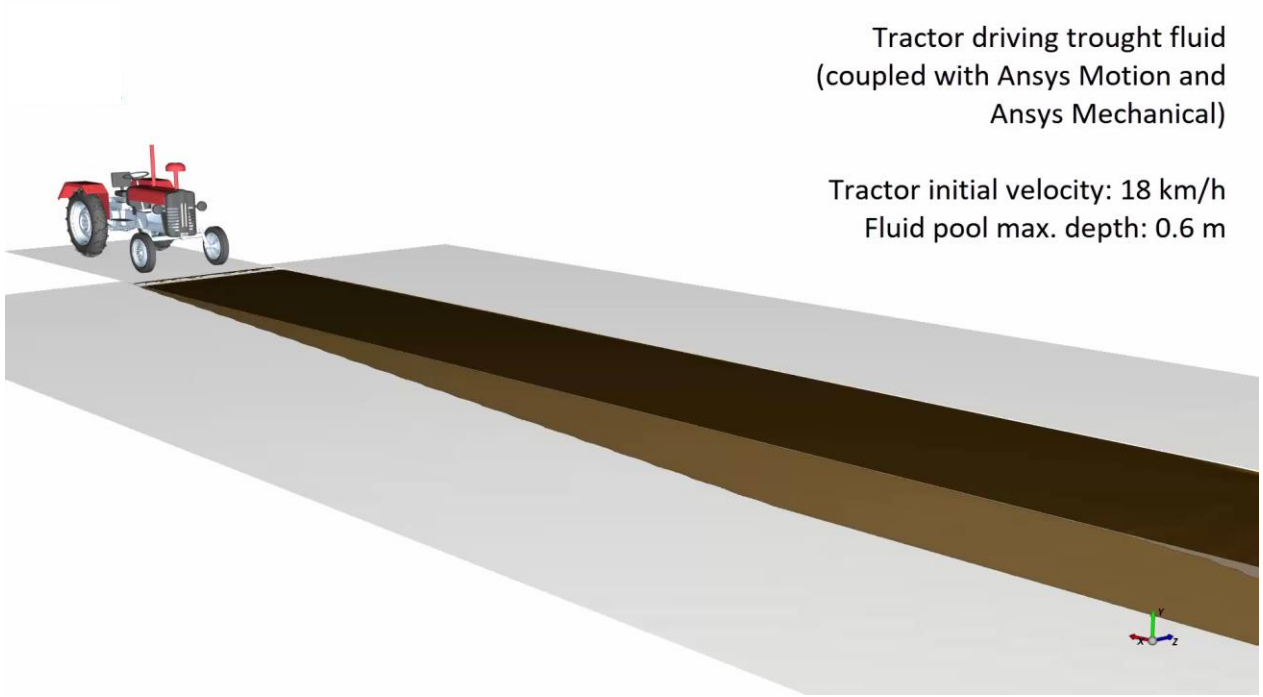
SPH application : Tractor Tires Performance in Mud



Coupling with **Ansys Motion** and **Ansys Mechanical**

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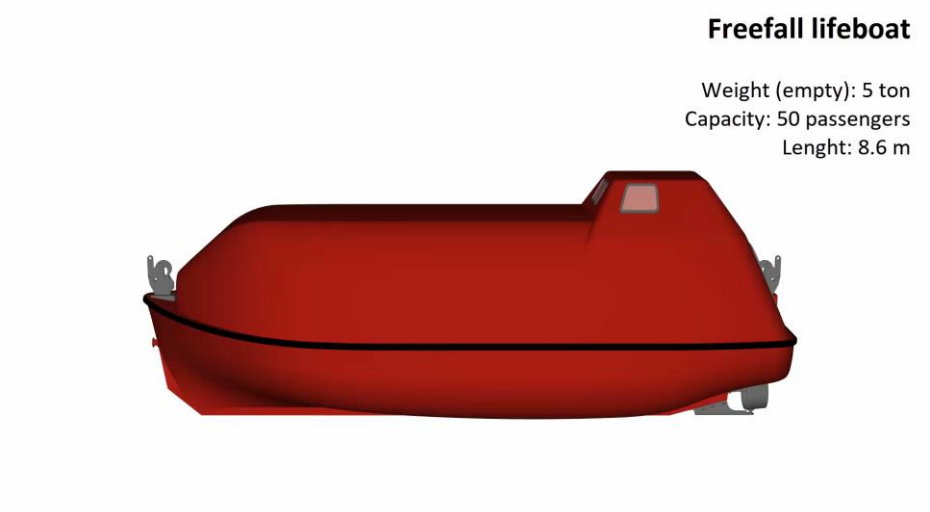
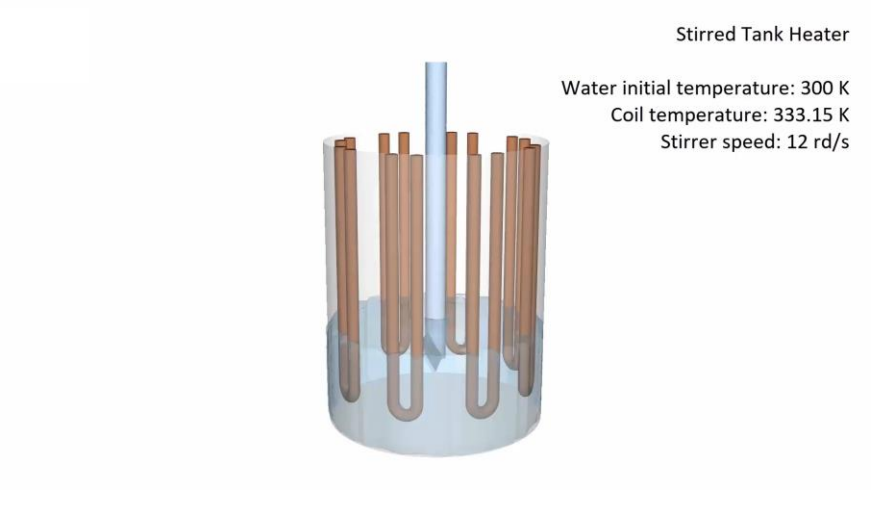
SPH application : Freefall lifeboat



Lifeboat launching dynamics can be analyzed considering different sea conditions, launch height, etc.



Heat transfer evaluation on stirred tank heater.

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SPH Enhanchements

Surface tension

- Applications: Fluid Spray, Dish Washing Machine.

Pressure outlet boundary condition setup

- Applications: User can prescribe the pressure at the fluid outlet.

Mass flow rate measurement

- Applications: User friendly and accurate measurement of any fluid mass flow, using standard or custom imported STL geometries.

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Injection Points

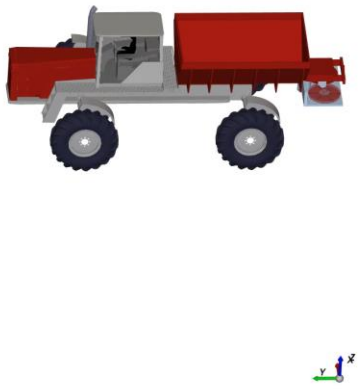
Innovative Particle and Fluid Injection Points

Flexible setup for inlet and outlet for particles and fluids

- The new concept of inlets and outlets, provides users **adding movements for particles (DEM) and fluids (SPH) injections, using any shaped imported geometries** as inlets and outlets, and easy mass flow measurements.

Tractor velocity: 18 km/h

Moving inlet allows particles to be injected along with geometry movement



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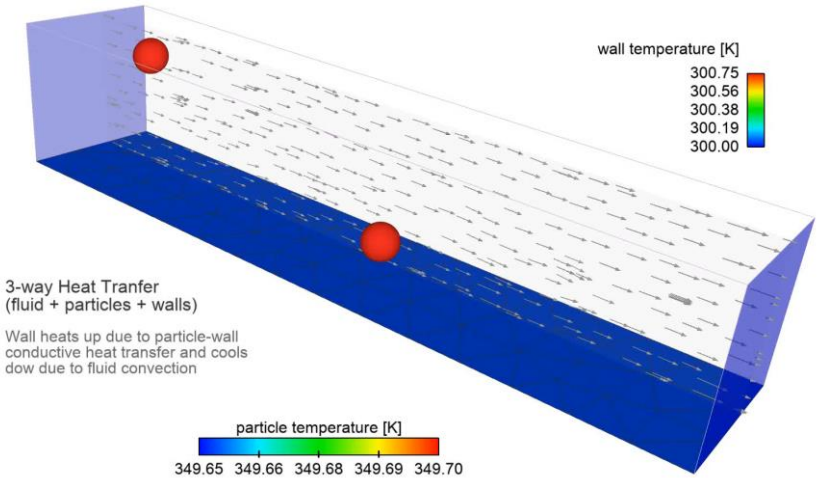
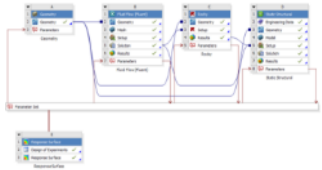
Ansys Integration

Full integration with Ansys tools

Ansys coupling new enhancements

- **Heat transfer between particles and walls** when using coupling with **Ansys Fluent** for solving particle laden flows.
- **Fluent 2-way coupling** available via **Workbench**
- **Ansys Motion** coupling and Rocky internal motion kernel can be combined in the same simulation case.
- **Ansys Motion** FMU* files can be exported using **Ansys Mechanical** interface.





Particles and walls can exchange heat in the Ansys Fluent coupling cases.

*FMU: Functional Mockup Unit

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…and more

Flexible particle: additional analysis

Post processing option: joint* statistics

- **Feature:** Forces, moments, displacements and stresses in joints, are available for post processing use.
- **Benefit:** Customers can visualize (with 3D-colored lines) all these items on each joint* of each flexible particle.

***Joint:** connections between each part of a flexible particle

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Additional Enhancements

- Improved volumetric diffusion algorithm for heterogeneous meshes (for Ansys Fluent coupled cases)
- Additional algorithm for higher performance on small PSD* cases (particles with similar size)

*PSD: Particle size distribution

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